1974

Crossbreeding Beef Cattle : A Guide for Using Simumate

Cooperative Extension, South Dakota State University

Extension Circular 701
November 1974

Crossbreeding Beef Cattle

A Guide for Using Simumate

TWO BREED ROTATION

REED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
NGCHA	713.	460.	435.	456.	-16.	
NGHER	695.	435.	427.	431.	-23.	110.
NGSIM	708.	453.	431.	449.	-20.	87.
HAHER	721.	469.	438.	465.	-27.	91.
HASIM	733.	487.	441.	484.	-24.	71.
ERSIM	715.	461.	434.	458.	-31.	85.

THREE BREED ROTATION

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL
ANGCHAHER	89.9	0.88	506.	69.	87.	10.	35.	20.
ANGCHASIM	82.8	0.86	540.	61.	70.	8.	29.	9.
ANGHERSIM	86.6	0.88	512.	67.	85.	10.	35.	18.
CHAHERSIM	82.0	0.86	534.	61.	71.	8.	29.	13.

THREE BREED ROTATION

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANGCHAHER	712.	456.	435.	452.	-22.	101.
ANGCHASIM	721.	468.	437.	465.	-20.	89.
ANGHERSIM	709.	451.	433.	448.	-25.	97.
CHAHERSIM	726.	474.	439.	470.	-27.	87.

SPECIALIZED CROSS-BULL BREED FIRST COWS TWO BREED ROTATION NEXT

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL
ANG CHAHER	87.6	0.86	498.	59.	91.	10.	36.	24.
ANG CHASIM	78.0	0.84	542.	46.	68.	8.	28.	10.
ANG HERSIM	83.1	0.88	506.	56.	87.	10.	35.	21.
CHA ANGHER	95.7	0.88	491.	75.	95.	10.	38.	22.
CHA ANGSIM	84.3	0.85	536.	62.	72.	8.	29.	9.
CHA HERSIM	83.1	0.85	524.	58.	76.	8.	31.	15.
HER ANGCHA	89.0	0.88	517.	68.	82.	9.	33.	16.
HER ANGSIM	84.3	0.89	525.	67.	78.	9.	31.	14.
HER CHASIM	78.0	0.85	550.	53.	64.	7.	26.	8.
SIM ANGCHA	89.0	0.85	527.	64.	76.	8.	31.	11.
SIM ANGHER	95.7	0.89	491.	77.	95.	10.	38.	22.
SIM CHAHER	87.6	0.85	515.	61.	79.	9.	33.	17.

SPECIALIZED CROSS-BULL BREED FIRST COWS TWO BREED ROTATION NEXT

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANG CHAHER	718.	460.	438.	457.	-20.	101.
ANG CHASIM	729.	475.	442.	471.	-16.	84.
ANG HERSIM	714.	455.	436.	451.	-23.	93.
CHA ANGHER	704.	450.	430.	446.	-27.	100.
CHA ANGSIM	715.	464.	434.	460.	-23.	83.
CHA HERSIM	722.	471.	437.	467.	-30.	83.
HER ANGCHA	712.	456.	435.	453.	-22.	97.
HER ANGSIM	708.	451.	432.	448.	-24.	91.
HER CHASIM	730.	478.	442.	474.	-25.	80.
SIM ANGCHA	715.	465.	434.	461.	-22.	89.
SIM ANGHER	701.	445.	428.	442.	-29.	99.
SIM CHAHER	722.	472.	438.	468.	-29.	88.

Cooperative Extension Service ● South Dakota State University ● U.S. Department of Agriculture

What's Inside:

Crossbreeding Beef Cattle

A Guide for Using Simumate

By
J. A. Minyard, manager, West River Agricultural Research and Extension Center, Rapid City, and **C. A. Dinkel,** professor, Animal Science Department, Agricultural Experiment Station, South Dakota State University, Brookings.

Crossbreeding is not new to South Dakota cattlemen, but only in recent years has it become widespread in its use. More than 60% of the commercial cattlemen responding to a 1972 survey by the Cooperative Extension Service indicated they used crossbreeding.

Although it is widely used, many producers still need and seek assistance in choosing breeds and specific crossbreeding systems that will work best in their own operation.

Crossbreeding Opportunities

Crossbreeding provides two opportunities for increasing productivity of commercial beef cattle:

1. To take advantage of hybrid vigor (heterosis) both in the brood cow and in her offspring.
2. To combine desirable characteristics of two or more breeds to achieve a combination of traits not available in any one breed.

Hybrid vigor or heterosis is the difference in performance between crossbred animals and the average of the parental breeds used in the cross. The results of extensive research on crossbreeding indicate that:

Most heterosis is observed in traits low in heritability. These include fertility, livability and mothering ability. These are traits of particular importance to the cow-calf producer and heterosis in these traits emphasizes the need to utilize the crossbred cow.

Magnitude of heterosis is affected by the degree of relationship between parents crossed. Greater responses have been observed between breed crosses than between crosses of lines within a breed. Further, crosses among breeds which have the most diverse background appear to yield the most heterosis response.

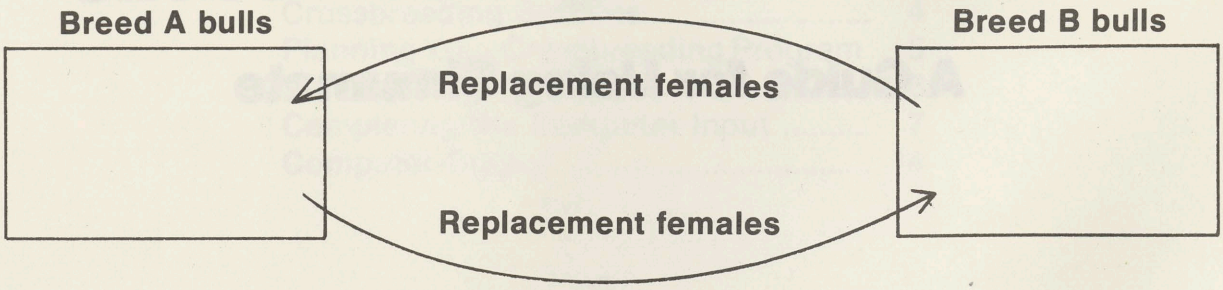
Opportunities in crossbreeding from combining desirable characteristics of two or more breeds in a crossbred population rests on three basic assumptions:

1. There are significant differences between breeds available for crossbreeding.
2. Breed differences in the economically important traits are due, in part at least, to additive genetic differences. That is, they are heritable.
3. No one breed excels all others in all traits. Most breeds have some strong points and all breeds have some weaknesses.

Benefits from crossbreeding will be maximized by considering both breed strengths and heterosis. Choice of breed(s) should be based on strengths which complement weaknesses of the present herd. Fortunately, crosses of breeds that differ widely appear to display greater amounts of heterosis.

Crossbreeding Systems

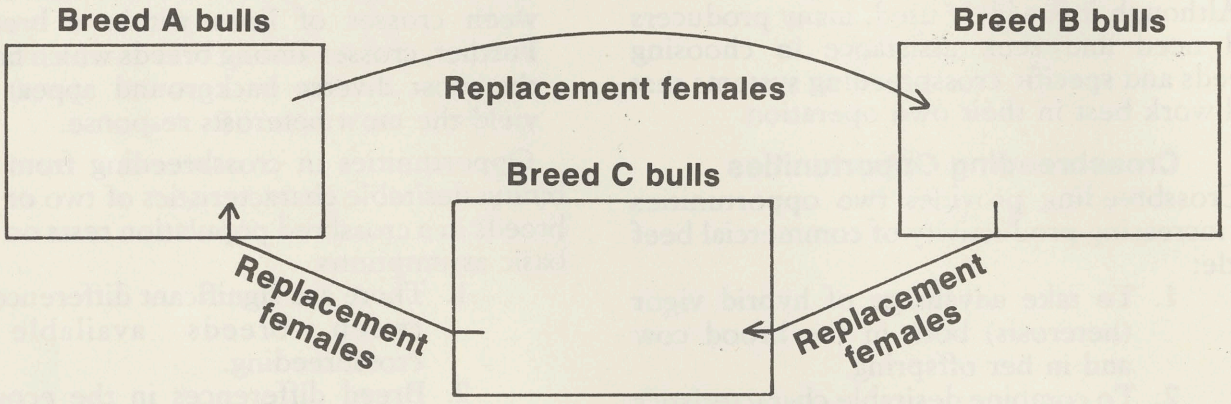
Two Breed Crisscross



Consider the blocks in the two-breed-crisscross diagram as two breeding pastures. Replacement females sired by bulls of Breed A will be mated to bulls of Breed B for their productive life. Replacement females sired by bulls of Breed B will, in turn, be mated for their entire life to bulls of Breed A. Two breeding pastures, a cooperative agreement between two herds or artificial insemination are required to make this system work.

Individual and maternal heterosis will stabilize at about 67% of the maximum, which is attained in the first cross. This system seems best suited for moderate-size operations. Disadvantages of the system include the sacrifice of some heterosis and it does not provide the possibility for using separate bull and cow breeds in a specialty role.

Three Breed Rotation



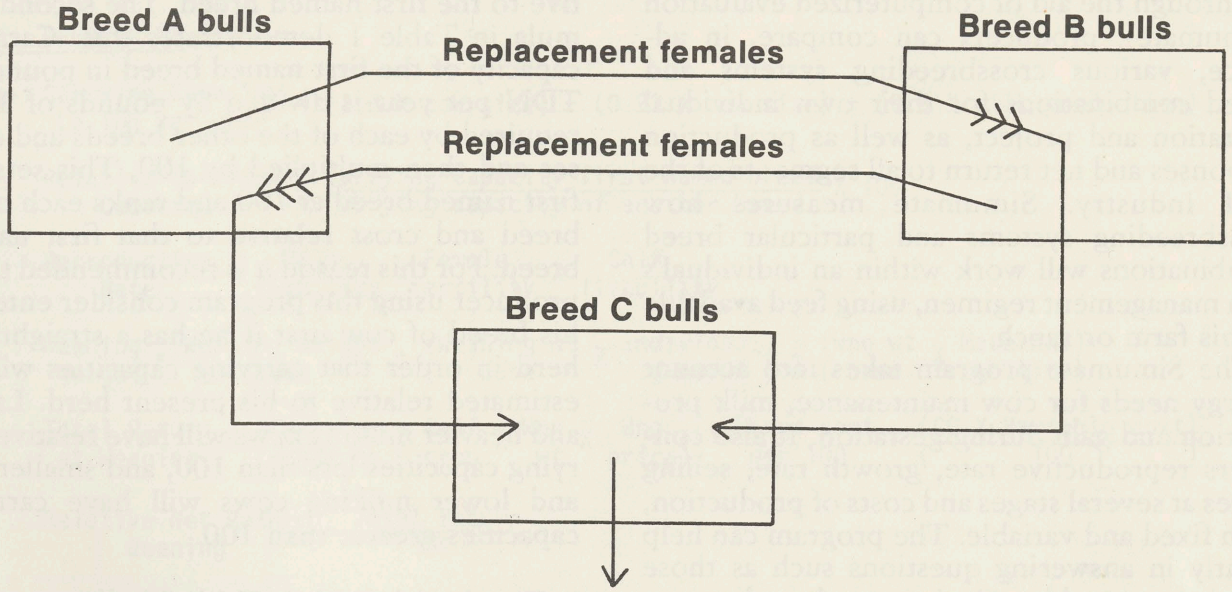
Consider the blocks in the three-breed rotation diagram as three breeding pastures each assigned to bulls representing a different breed. Replacement females sired by bulls of Breed A will be mated to bulls of Breed B; replacement females sired by bulls of Breed B will be mated to bulls of Breed C; and replacement females sired by bulls of Breed C will be mated to bulls of Breed A each for their entire life.

Three breeding pastures, a cooperative arrangement between three herds or artificial insemination will be required to make this system work. It would appear to be practical only in large commercial operations.

Individual and maternal heterosis in this system stabilizes at about 86% of maximum, about 20% greater than with the two-breed crisscross.

Disadvantages of this system will often be related to the management input required. It does not provide the possibility for using separate bull and cow breeds in a specialty role and adds the challenge of finding three breeds which will complement each other.

Specialized Three Breed Crossing System



Replacement females sired by bulls of Breed A will be mated as 1-2-and 3-year-olds to bulls of Breed B. Replacement females sired by bulls of Breed B will be mated as yearlings, twos and threes to bulls of Breed A. Replacement females are only kept from these matings. Cows 4 years old and over will be mated to bulls of Breed C. All offspring from this cross will be used for commercial slaughter purposes.

Management requirements will be similar to that of a three breed rotation. This system seems most suitable for larger herds.

Maternal heterosis will stabilize at about 67% of maximum. However, it provides several other potential advantages:

Allows one to utilize breeds superior in maternal traits on the female side and mate slightly more than one-half the cow herd to bulls from a specialized bull breed.

Maximizes individual heterosis in a majority of the offspring.

Adapting Crossbreeding to Individual Herds

Considerations of crossbreeding and crossbreeding systems and projections of probable impact on productivity have been based primarily on production response trait by trait. That is, specific production responses such as improved fertility, calf livability, milk production, preweaning growth, postweaning growth, have been considered.

This "piece-meal" approach to evaluating crossbreeding responses has not allowed adequate assessment of total "net" response at all levels in the industry. Additionally, it has not allowed effective consideration of specific physical and management characteristics of individual operations in selecting the best combination of crossbreeding system and choice of breeds to be employed.

When considering individual production responses several questions are raised relative to the total impact of a crossbreeding program: If large growth breeds are employed so that mature size increases significantly, how does cow size influence carrying capacity? Winter supplementation requirements?

Apart from cow size, what happens to per cow production costs with increased productivity? How does reproductive rate influence net return to the cow-calf producer?

How do changes in weaning weight and beef type affect per pound selling price of feeder calves?

How do differences in available breeds and breeding systems affect maximization of returns to all segments of the industry?

The Simumate Program

Through the aid of computerized evaluation (Simumate), producers can compare, in advance, various crossbreeding systems and breed combinations for their own individual operation and project, as well as production responses and net return to all segments of the beef industry. Simumate measures how crossbreeding systems and particular breed combinations will work within an individual's own management regimen, using feed available on his farm or ranch.

The Simumate program takes into account energy needs for cow maintenance, milk production and gain during gestation. It also considers reproductive rate, growth rate, selling prices at several stages and costs of production, both fixed and variable. The program can help greatly in answering questions such as those listed above and in tailoring crossbreeding systems to fit individual operations and still be profitable to the industry.

What The Program Does

Having considered need for the program, the next step will be to understand the necessary calculations. Table 1 is a summary of the basic preweaning and postweaning calculations. Some will be performed in a slightly different manner than indicated because of the need to adjust for factors that may differ from crossbreeding system to crossbreeding system. For example, levels of heterosis are zero in the straightbreds and at different levels for the different crossbreeding systems. For simplicity only the basic formulas are presented in Table 1.

Most of these formulas will be familiar but an exception is the first one listed for carrying capacity. This formula was taken from Neville and McCullough (1969)* and represents the calculation of pounds of Total Digestible Nutrients, (TDN), required to carry a cow a year.

The first factor (3.6 multiplied by weight of cow in pounds) estimates pounds of TDN required to maintain a cow in lactation 7 months and dry 5 months.

The next term (.23 multiplied by cow size in pounds) represents pounds of TDN required for growth and development of the calf during gestation. The last term in the formula estimates TDN required to support milk production of the cow. Pounds of TDN required for each straight breed and each of the crosses is calculated.

Carrying capacity, however, is reported relative to the first named breed. The second formula in Table 1 demonstrates this. Carrying capacity of the first named breed in pounds of TDN per year is divided by pounds of TDN required by each of the other breeds and crosses and then multiplied by 100. This sets the first named breed at 100 and ranks each other breed and cross relative to that first named breed. For this reason it is recommended that a producer using this program consider entering his breed of cow first if he has a straightbred herd in order that carrying capacities will be estimated relative to his present herd. Larger and heavier milking cows will have relative carrying capacities less than 100, and smaller size and lower milking cows will have carrying capacities greater than 100.

The third formula in Table 1 indicates reproductive rate. This is estimated by multiplying male fertility by female fertility by calf livability. For most producers it is worthwhile taking some examples and performing these multiplications. *Very small losses in either of these three factors can substantially reduce calf crop weaned.* For example, even if one is able to maintain 98% in all three, calf crop weaned is only 94%. If each factor drops to 95%, then calf crop weaned drops to 86%. These figures help emphasize the importance of each of these factors.

Weaning weight is calculated from the weaning weight base, individual growth, and maternal ability that are provided by the user. This may be the item that will give most users the most trouble. All three items must be considered relative to each other in order that weaning weight calculated be representative or typical of the breed or cross. *The weaning weight base is simply a starting point for this calculation.* Individual growth is a percentage figure (plus or minus) which indicates the relative position of a breed in preweaning growth rate. Maternal ability indicates the position of the breed (plus or minus) in its milking ability. Thus, a breed with a plus growth rate or a plus maternal ability will be heavier at weaning and one with negative value will be lighter at weaning. If we were to take a 400-pound weaning base with a plus 5% individual growth factor and a plus 8% maternal ability factor, we would increase the

*Neville, W. E., Jr. and M. E. McCullough. 1969. Calculated energy requirements of lactating and non-lactating Hereford cows. J. Anim. Sci. 29:823.

Table 1 Simumate Calculations

I. PREWEANING

$$\text{Carrying Capacity Lb TDN per year} = (3.6 \times \text{cow size}) + (0.23 \times \text{cow size}) + (0.3 \times \text{milk production})$$

$$\text{Relative Carrying Capacity} = \frac{\text{Carrying capacity first named breed}}{\text{Carrying capacity of another breed}} \times 100$$

$$\text{Reproductive Rate} = \text{Male fertility} \times \text{Female fertility} \times \text{Calf livability}$$

$$\text{Weaning Weight} = \text{Weaning weight base} + (\text{Weaning wt base} \times \text{Individual growth}) + (\text{Wng wt base} \times \text{Maternal ability})$$

$$\text{Total Return at Weaning} = (\text{Carrying capacity} \times \text{Calf crop} \times \text{Wng wt} \times \text{Wng price}) - \text{Fixed cost per 100} - \left(\frac{\text{CC} \times \text{Variable cost}}{100}\right)$$

$$\text{Relative Net Return Weaning} = \frac{\text{Total return}}{100}$$

I. POSTWEANING

$$\text{Net Return Background} = (\text{Selling price} \times 700 \text{ lb}) - (\text{Wng wt} \times \text{Wng price}) - (\text{Fixed costs} \times \text{Days to 700 lb}) - \text{Feed costs}$$

$$\text{Net Return Feedlot} = (\text{Selling price} \times \text{Slaughter weight}) - (\text{Fixed costs} \times 140 \text{ days}) - \text{Feed costs} - (\text{Background price} \times 700 \text{ lb})$$

$$\text{Packer Return} = (\text{Carcass weight} \times \text{Carcass price}) - (\text{Slaughter weight} \times \text{Feedlot price})$$

$$\text{Industry Return Individual} = \text{Weaning net return} + \text{Background return} + \text{Feedlot return} + \text{Packer return}$$

$$\text{Industry Return Unit} = (\text{Weaning net return} \times 100) + [\text{Carrying capacity} \times \text{Calf crop} \times (\text{Background return} + \text{Feedlot return} + \text{Packer return})]$$

weaning weight of the breed 20 pounds for its preweaning growth and 32 pounds for its maternal ability, giving it a weaning weight of 452 pounds. A breed with a plus 14% individual growth and a minus 5% maternal ability would gain 56 pounds in growth and lose 20 pounds in maternal ability, resulting in a weaning weight of 436 pounds. Users will need to consider individual growth and maternal ability estimates in relation to the weaning weight base in order to estimate the breed's weaning weight at the desired level.

The remaining calculations, both preweaning and postweaning, are of net return to labor. These are primarily calculations of gross return less costs involved. The only exceptions are the relative net return at weaning which places return on an individual rather than a unit basis and the industry return which is a sum of net returns at the four phases (weaning, background, feedlot and packer). It is worth emphasizing the packer return is based only on sale of the carcass and does not include by-product and offal sales.

Suggestions for Completing Input Form

A sample input form is provided in Table 2. The first line should be filled in completely with name, address and zip code. The second line is for general information pertinent to the whole operation. The first two columns are to be used to indicate number of breeds to be considered. The program will take up to 10 breeds and a user is encouraged to include more than just the ones he thinks he will use.

NAME _____ ADDRESS _____

_____ ZIP _____

Table 2. Sample input, and form for supplying input.

Input Form as described and used in Extension Circular No. 701, "Crossbreeding Beef Cattle -- A Guide for Using Simumate," Cooperative Extension Service, South Dakota State University, Brookings

NO. BREEDS		COST/100 COWS										WNG WT BASE			FEED COST Cents per lb of ration								FIXED COST Cents per day						BASE FEED REQUIREMENT						CARCASS PRICE		GRADE SPREAD		
		Fixed					Variable								Bkgnd			Growth			Finish			Bkgnd		Grow		Fin		Bkgnd		Grow		Fin						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
	8	0	7	5	0	0	0	6	0	0	0	4	0	0	0	2	0	0	2	3	0	2	5	1	1	1	1	1	1	9	0	8	2	7	5	6	2	0	3	0

Breed Estimates

BREED			COW SIZE				ANNUAL MILK PROD				MALE FER-TILITY		FEMALE FER-TILITY		CALF LIVA-BILITY		INDIVIDUAL GROWTH			MATERNAL ABILITY			WEAN-ING PRICE		DAILY GAIN									BREED-FEED Efficiency			SELLING PRICE				DRESSING PERCENT		CUT ABILITY		PERCENT CHOICE		
																									Bkgnd			Grow			Finish						Bkgnd		Feedlot								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
A	N	G	1	0	5	0	2	4	0	0	9	2	9	6	9	5	0	0	8	0	0	5	5	1	2	0	0	2	7	0	2	7	0	0	0	3	4	6	4	0	6	3	6	2	9	0	ANG
C	H	A	1	2	5	0	2	8	0	0	9	0	9	2	9	0	0	2	2	0	0	7	5	0	2	3	0	3	4	0	3	4	0	—	0	3	4	5	3	9	6	2	6	7	4	0	CHA
H	E	R	1	1	2	5	2	0	0	0	9	6	9	6	9	2	0	1	4	—	0	5	5	3	2	1	0	3	0	0	3	0	0	0	0	0	4	8	4	1	6	2	6	3	7	5	HER
H	O	L	1	3	0	0	4	5	0	0	9	4	9	0	9	0	0	1	8	0	1	2	4	9	2	2	5	3	3	0	3	3	0	0	0	0	4	1	3	7	5	9	6	6	5	0	HOL
J	E	R		9	0	0	3	6	0	0	9	4	9	6	9	4	—	0	9	0	1	0	4	6	1	7	0	2	0	0	2	0	0	0	0	6	3	9	3	6	5	8	6	2	4	0	JER
L	I	M	1	1	6	0	2	2	0	0	9	2	9	4	9	2	0	1	2	0	0	0	5	0	2	1	0	3	0	0	3	0	0	—	0	3	4	5	4	0	6	2	6	8	3	0	LIM
P	O	L	1	0	5	0	3	0	0	0	9	4	9	5	9	5	0	0	8	0	0	8	5	0	2	0	0	2	7	0	2	7	0	0	0	3	4	2	3	8	6	0	6	5	6	0	POL
S	H	O	1	1	0	0	2	6	0	0	9	6	9	2	9	4	0	1	0	0	0	6	5	1	2	0	0	2	7	0	2	7	0	0	0	3	4	6	4	1	6	2	6	0	8	0	SHO
S	I	M	1	3	0	0	4	0	0	0	9	2	9	4	9	0	0	2	2	0	1	1	5	0	2	3	0	3	4	0	3	4	0	—	0	3	4	5	3	9	6	1	6	6	4	0	SIM
S	W	I	1	2	5	0	4	0	0	0	9	4	8	8	9	0	0	1	8	0	1	1	5	0	2	2	0	3	3	0	3	3	0	0	0	0	4	4	3	9	6	0	6	6	4	0	SWI

SIMUMATE II SOUTH DAKOTA STATE UNIVERSITY

Table 3. Sample Simumate output.

THESE ESTIMATES PROVIDED BY

I M RANCHER ANYWHERE

N	WEANING COSTS FIXED	WEANING COSTS VARIABLE	WNG BASE	FEED COST PER LB. BACK	FEED COST PER LB. GROW	FEED COST PER LB. FINISH	FIXED COST PER DAY BACK	FIXED COST PER DAY GROW	FIXED COST PER DAY FINISH	BASE FEED REQUIRE. BACK	BASE FEED REQUIRE. GROW	BASE FEED REQUIRE. FINISH	CHOICE PRICE	GRADE SPREAD
4	7500.	6000.	400.	0.020	0.023	0.025	0.11	0.11	0.11	9.0	8.2	7.5	0.62	0.030

BREED	COW SIZE	MILK PROD	MALE FERT	FEM FERT	CALF LIVA	IND GROW	MATERN ABILTY	WNG PRICE	DAILY GAIN BACK	DAILY GAIN GROW	DAILY GAIN FINISH	FEED EFF	SELL PRICE BACK	SELL PRICE FEED	DRESS PCT	CUT ABLTY	PCT CHOICE
ANG	1050.	2400.	0.92	0.96	0.95	0.08	0.05	0.51	2.00	2.70	2.70	0.03	.46	.40	0.63	0.62	0.90
CHA	1250.	2800.	0.90	0.92	0.90	0.22	0.07	0.50	2.30	3.40	3.40	-.03	.45	.39	0.62	0.67	0.40
HER	1125.	2000.	0.96	0.96	0.92	0.14	-.05	0.53	2.10	3.00	3.00	0.0	.48	.41	0.62	0.63	0.75
SIM	1300.	4000.	0.92	0.94	0.90	0.22	0.11	0.50	2.30	3.40	3.40	-.03	.45	.39	0.61	0.66	0.40

CARRYING CAPACITY BASE IS 4756. LBS. TDN PER ANIMAL PER YEAR

THESE RESULTS BASED ON ESTIMATES MADE BY

I M RANCHER ANYWHERE

STRAIGHTBRED PERFORMANCE

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL	SLTR WT	FEEDLOT COSTS FEED	FEEDLOT COSTS FIXED	FEEDLOT NET RETURN INDIVIDUAL
ANG	100.0	0.84	452.	55.	124.	14.	46.	32.	1078.	73.	15.	21.
CHA	84.3	0.75	516.	30.	80.	9.	32.	16.	1176.	87.	15.	41.
HER	96.6	0.85	436.	56.	126.	14.	48.	44.	1120.	79.	15.	29.
SIM	76.7	0.78	532.	31.	73.	8.	29.	12.	1176.	87.	15.	41.

STRAIGHTBRED PERFORMANCE

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANG	679.	421.	419.	418.	-12.	95.
CHA	729.	489.	439.	485.	-20.	68.
HER	694.	437.	425.	434.	-34.	95.
SIM	717.	473.	432.	470.	-27.	58.

TWO BREED ROTATION

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL	SLTR WT	FEEDLOT COSTS FEED	FEEDLOT COSTS FIXED	FEEDLOT NET RETURN INDIVIDUAL
ANGCHA	89.0	0.85	514.	59.	84.	9.	33.	16.	1141.	83.	15.	34.
ANGHER	95.7	0.90	473.	76.	107.	12.	42.	30.	1112.	79.	15.	27.
ANGSIM	84.3	0.86	522.	59.	80.	9.	32.	14.	1141.	83.	15.	34.
CHAHER	87.6	0.85	506.	59.	85.	9.	34.	21.	1163.	86.	15.	39.
CHASIM	78.0	0.81	555.	44.	61.	7.	25.	5.	1192.	90.	15.	45.
HERSIM	83.1	0.87	514.	59.	82.	9.	33.	19.	1163.	86.	15.	39.

TWO BREED ROTATION

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANGCHA	713.	460.	435.	456.	-16.	93.
ANGHER	695.	435.	427.	431.	-23.	110.
ANGSIM	708.	453.	431.	449.	-20.	87.
CHAHER	721.	469.	438.	465.	-27.	91.
CHASIM	733.	487.	441.	484.	-24.	71.
HERSIM	715.	461.	434.	458.	-31.	85.

THREE BREED ROTATION

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL	SLTR WT	FEEDLOT COSTS FEED	FEEDLOT COSTS FIXED	FEEDLOT NET RETURN INDIVIDUAL
ANGCHAHER	89.9	0.88	506.	69.	87.	10.	35.	20.	1143.	83.	15.	34.
ANGCHASIM	82.8	0.86	540.	61.	70.	8.	29.	9.	1162.	86.	15.	38.
ANGHERSIM	86.6	0.90	512.	69.	85.	9.	34.	18.	1143.	83.	15.	34.
CHAHERSIM	82.0	0.86	534.	61.	71.	8.	29.	13.	1177.	88.	15.	42.

THREE BREED ROTATION

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANGCHAHER	712.	456.	435.	452.	-22.	101.
ANGCHASIM	721.	468.	437.	465.	-20.	89.
ANGHERSIM	709.	451.	433.	448.	-25.	97.
CHAHERSIM	726.	474.	439.	470.	-27.	87.

SPECIALIZED CROSS-BULL BREED FIRST COWS TWO BREED ROTATION NEXT

BREED	CARRY CAP	CALF CROP	WNG WT	NET RETURN	DAY TO 700	BACKGRD COSTS FIXED	BACKGRD COSTS FEED	BACK NET RETURN INDIVIDUAL	SLTR WT	FEEDLOT COSTS FEED	FEEDLOT COSTS FIXED	FEEDLOT NET RETURN INDIVIDUAL
ANG CHAHER	87.6	0.86	498.	59.	91.	10.	36.	24.	1145.	84.	15.	38.
ANG CHASIM	78.0	0.84	542.	46.	68.	8.	28.	10.	1166.	86.	15.	43.
ANG HERSIM	83.1	0.88	506.	56.	87.	10.	35.	21.	1145.	84.	15.	38.
CHA ANGHER	95.7	0.88	491.	75.	95.	10.	38.	22.	1141.	83.	15.	29.
CHA ANGSIM	84.3	0.85	536.	62.	72.	8.	29.	9.	1161.	86.	15.	35.
CHA HERSIM	83.1	0.85	524.	58.	76.	8.	31.	15.	1176.	88.	15.	39.
HER ANGCHA	89.0	0.88	517.	68.	82.	9.	33.	16.	1143.	83.	15.	34.
HER ANGSIM	84.3	0.89	525.	67.	78.	9.	31.	14.	1143.	83.	15.	34.
HER CHASIM	78.0	0.85	550.	53.	64.	7.	26.	8.	1179.	88.	15.	44.
SIM ANGCHA	89.0	0.85	527.	64.	76.	8.	31.	11.	1161.	86.	15.	35.
SIM ANGHER	95.7	0.89	491.	77.	95.	10.	38.	22.	1141.	83.	15.	29.
SIM CHAHER	87.6	0.85	515.	61.	79.	9.	33.	17.	1176.	88.	15.	39.

SPECIALIZED CROSS-BULL BREED FIRST COWS TWO BREED ROTATION NEXT

BREED	CARC WT	RET CUTS	MARKET VALUE CARC	MARKET VALUE ACTUAL	PACKER NET RET INDIVIDUAL	INDUSTRY NET INDIVIDUAL
ANG CHAHER	718.	460.	438.	457.	-20.	101.
ANG CHASIM	729.	475.	442.	471.	-16.	84.
ANG HERSIM	714.	455.	436.	451.	-23.	93.
CHA ANGHER	704.	450.	430.	446.	-27.	100.
CHA ANGSIM	715.	464.	434.	460.	-23.	83.
CHA HERSIM	722.	471.	437.	467.	-30.	83.
HER ANGCHA	712.	456.	435.	453.	-22.	97.
HER ANGSIM	708.	451.	432.	448.	-24.	91.
HER CHASIM	730.	478.	442.	474.	-25.	80.
SIM ANGCHA	715.	465.	434.	461.	-22.	89.
SIM ANGHER	701.	445.	428.	442.	-29.	99.
SIM CHAHER	722.	472.	438.	468.	-29.	88.

Columns 3 through 7 are for fixed costs associated with 100 cows in the user's operation. Columns 8 through 12 are for variable costs associated with 100 cows. Table 4 is included to help with the calculation of fixed and variable costs. In the example shown in Table 2, $7,500 in fixed costs and $6,000 in variable costs were required to carry 100 cows a year. This yields a per calf figure of $135 per year.

The next item is weaning weight base in columns 13,14 and 15. As indicated above, this base will have to be considered in relation to individual growth and maternal ability used for the breeds. Consult again the examples above.

The postweaning phases of the program are divided into backgrounding, growing and finishing periods. Backgrounding takes the calves to 700 pounds and the 140-day feedlot period is divided into a 50-day growing period and a 90-day finishing period. The next three sections of the second line starting at column 16 allow the user to *enter the feed cost in cents per pound of ration dry matter* for each of these three periods. In the example, feed costs are 2.0 cents per pound, 2.3 cents per pound and 2.5 cents per pound in the three periods. The next three sections, starting with column 25, allow the user to *enter fixed costs in cents per day.* Eleven cents per day is used in the example.

The next three sections allow the user to enter the base feed requirement for the three periods in *pounds of feed required to produce a pound of gain.* In the example in the backgrounding phase it takes 9 pounds of feed to produce a pound of gain and 8.2 and 7.5 pounds in the growing and finishing periods, respectively.

In column 37, the price of an average choice carcass is entered and the price spread between average choice and average good is entered starting in column 39. In the example, the choice carcass is listed as selling at 62 cents per pound with average good carcasses selling at 59 cents per pound (a 3-cent price spread).

The example is included in this table in order to assist the user. Where the user has different values for his operation or where markets have changed, these should be used. Where the user does not have information or is unable to get it for his operation, he may want to use those figures given in the example or adjust them in one direction or another prior to use. If the user wants to use the values given in the example, no entry is necessary. *Only changes need to be entered.*

Table 4, Beef budget (per cow).

	Av. S.D. Cost(b)	Your Cost	
FIXED			
Pasture	36.00	_____	
Winter feed (roughage)	27.00	_____	
Power and fuel	4.00	_____	
Depreciation and repairs on equipment	2.00	_____	
Housing	2.50	_____	
Total	71.50	_____	× 100 = _____ (1)
VARIABLE			
Grain - supplement - salt - mineral	6.00	_____	
Breeding charge	7.00	_____	
Vet. and medicine	2.00	_____	
Taxes and ins. on cow	4.00	_____	
Interest	20.00	_____	
Miscellaneous	3.00	_____	
Replacement(a)	8.00	_____	
Total	50.00	_____	× 100 = _____ (2)

(1) Enter this figure in Columns 3 through 6 in Card 2 - Table 2.
(2) Enter this figure in Columns 7 through 10 in Card 2 - Table 2.
a Costs exceeding credit from cull cow.
b These values are for guidance only and cannot be currently accurate.

Breed Estimates

The remaining lines of Table 2 contain information for each breed the user wants to consider. Sample information is provided for 10 breeds. Should the user want to consider a breed not included in the example, the entire line must be completed for the breed, including the breed name abbreviation in columns 1, 2 and 3. The user should indicate by check mark or a "1" in the left margin the breed that is to be entered first. Refer to carrying capacity estimation above.

Breed designation, restricted to three letters, is to be placed in columns 1, 2 and 3. Fill in this designation for each breed to be considered. *The remaining items need to be filled in only if there is a change from the information indicated in the example.*

Cow size appears in columns 4 through 7 and represents the mature weight of a cow of that breed in pounds.

Columns 8 through 11 contain the estimated annual milk production. Many users will not have much information relative to annual milk production and will have to rely primarily on those given in the example. Milk production is generally not as well known as is cow size, for example. However, some estimates are available and more will become available which will allow us to improve our estimation. At present, however, it would be better to consider the effect of breed differences in this trait, even with some error in the estimates, than to overlook entirely the cost of producing the milk.

The next three items, male fertility, female fertility and calf livability, are involved in calculating reproductive rate. Male fertility and female fertility in some respects will be "seat of the pants" estimates. Producers generally will have some feel for the breeds as bull breeds and as cow breeds on a fertility basis. These estimates may vary from one area to another since the breeds may vary according to the fertility levels of the herds supplying breeding stock in that area. The newer, recently imported breeds will not be as well known, particularly as straightbreds. Care should be taken not to enter information based on crossbred performance in this table. *This table is for straightbred estimates only.* Since straightbred cows of these newer breeds have not been carried under our beef management systems and environments, estimates of fertility for them must be based on the performance of physiologically similar breeds in this country. For example, a large size, high milking imported breed might be expected to be similar in female fertility to the Holstein or Brown Swiss breeds under beef management in this country. Male fertility for the imported breeds might be set at the expected fertility rate in an artificial insemination situation since these breeds generally have been available only through imported semen. At such time as high percentage or registered bulls are available in these breeds, male fertility information will become available and other estimates may then be used.

Consideration should be given to adjusting female fertility for level of nutrition prior to and during the breeding season. Larger, heavier milking cows will require a higher plane of nutrition to maintain a high level of reproduction than will smaller or lower milking cows. The third factor, calf livability, also expressed as a percent, is another estimate that producers will generally have a feel for, although some degree of estimation will be involved here, too.

Individual growth and maternal ability in columns 18 to 20 and 21 to 23, respectively, have already been discussed above in relation to calculations. Care should be taken in completing these columns for the various breeds in order that the resulting weaning weight represents the breed weaning weight the producer expects. This will mean calculating a straightbred weaning weight using the weaning weight base and the individual growth and maternal ability figures.

The expected selling price per pound of each straightbred is to be entered in columns 24 and 25. The program automatically adjusts this selling price in the amount of 1 cent per 50 pounds above or below the weaning weight base. Thus, in the example, calves weighing above 450 pounds but less than 500 pounds would sell for 1 cent less than the listed price for that breed.

Postweaning daily gains for the three periods in pounds per day are given in the next nine columns. Columns 35, 36 and 37 contain the breed feed efficiency. *Figures entered here are in percent and are plus or minus.* A plus indicates they take more feed per pound of gain and a minus indicates they take less feed per pound of gain. These percentage feed efficiency figures are applied to the base feed requirements of line 2. For example, Angus is given a plus 3%

feed efficiency in the example which would mean in the backgrounding phase straightbred Angus would consume 9.27 pounds of feed per pound of gain. Charolais is given a minus 3% feed efficiency and they would be consuming 8.73 pounds of feed per pound of gain.

Expected selling prices from background and feedlot are entered in the next four columns in cents per pound.

Expected dressing percent of each straightbred following 140 days feed beyond 700 pounds is entered in columns 42 and 43.

Columns 44 and 45 are headed cutability. Actually, this is percent yield of edible portion and is not the USDA cutability grade which is based on yield of the four primal cuts. The figures entered here will be somewhat larger than the USDA cutability because of additional edible portion over and above the four primal cuts.

The last two columns, 46 and 47, contain the proportion of slaughter animals expected to grade choice following 140 days feed beyond 700 pounds.

Computer Output

The computer first lists the estimates provided by the user. These should be checked carefully to see that they agree with the original inputsheet. Errors in reading and punching can be detected and if any occur the sheets should be returned for reprocessing.

The carrying capacity base is indicated immediately below the input table. Table 3 is a sample output using four of the breeds presented in Table 2. The carrying capacity base is the pounds of TDN required to carry one cow of the first named breed. As indicated in the section on calculations, all carrying capacities are calculated in relation to this breed.

The straightbred performance of each breed entered is given in the next section of output. The calculations section should explain most of these items with the exception of the two market values, carcass and actual, and the two industry net returns. Market value based on a carcass weight and grade evaluation using the carcass price and grade spread given is listed under *market value, carcass.* The value of the retail cut yield regardless of grade is given under *market value, actual.*

Industry net individual is an accumulation of net return on an individual basis from weaning, backgrounding, feedlot and packer. This is probably the best indication for a producer of the profitability of his cattle across the industry. The industry net on a unit basis extends the lower carrying capacity and lower reproductive rates past weaning into the postweaning phases. Thus, this evaluation is probably a better indication of the breed or cross in total efficiency from an industrywide standpoint.

Subsequent sections of the output present the two breed rotation results, the three breed rotation results and the specialized cross results. Rotations are indicated without a space between the names (ANGHER) and this indicates bulls of each breed in use with the crossbreeding system carried on long enough to be at equilibrium. The specialized cross is made up of two breed rotation cows indicated by the two breeds on the right mated to the bull of a breed indicated on the left and separated by a space (CHA ANGHER).

Further information regarding details of the program may be obtained from the publication, "Choosing Breeds and Crossbreeding Systems by Computer," available from the Animal Science Department at South Dakota State University, Brookings, SD, 57006.

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